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Pyrenula chlorospila (Nyl.) Arnold (Pyrenulaceae), a new addition to lichen biota of India

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Abstract

Climatic conditions and physical features of the Eastern Himalayan region encompasses a rich diversity of lichen biota. However, the region's lichens are still far from extensively explored. Here, we study the genus *Pyrenula* Ach. from the Dhubri district of Assam in North-East India. Twelve species of *Pyrenula* have been recorded, of which one of the species, *P. chlorospila* (Nyl.) Arnold, is a newly reported from India. Morphotaxonomic comments on this species, emphasizing its distribution, are provided.

Keywords

New record, North-East India, taxonomy

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Introduction

The number of lichens known from India continues to increase and currently 2963 species in 468 genera and 84 families are known (Sinha 2021). India has rich diversity of pyrenocarpous lichens, with about 382 species in 49 genera and 12 families. The warm, moist conditions in the Eastern Himalaya, including Assam, favours a rich diversity of pyrenocarpous lichens of about 295 species (Mishra et al. 2020). Generally, these lichens grow on tree bark, rocks, soil, and leaves. Trees having smooth, shaded bark are the most preferred. Among the pyrenocarpous lichens, the family Pyrenulaceae is dominant with *Pyrenula* Ach. the dominant genus. Aptroot (2012) listed 745 species of *Pyrenula* worldwide. The genus is characterized by an olivaceous green or brownish to yellowish thallus. Pseudocyphellae and maculae may be or may not be present. The ascocarp is of the perithecia type, which may be covered by the thallus or naked in upper part solitary or rarely 2 or 3 confluent. The peridium is carbonized and either spreading laterally or not. The ostioles are apical or lateral, and the paraphyses are simple and rarely branched. Each asci bears eight spores. Ascospores are brown and transversely septate or

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muriform, with or without lichexanthone and anthraquinones (Awasthi 1991, Ingle 2018). Upreti (1990, 1991a, 1991b, 1992, 1993) made extensive revisionary studies on the *Pyrenula* of India and described several new species, as well as reports of species from the country. Jagadesh Ram et al. (2005) newly described *Pyrenula subcylindrica* Jagadesh & Upreti from India. Thus, India is represented by 83 species of *Pyrenula* and greatest diversity of species is reported from the Western Ghats and the Eastern Himalayan Region (Mishra et al. 2020; Rajaprabu et al. 2021). Among the northeastern states, Assam is one of the states with significant number of lichen studies and novel species reports from India. Altogether, 525 species of lichens have been reported from Assam, of there are 59 *Pyrenula* species (Daimari 2016; Gupta and Sinha 2018; Gogoi et al. 2019, 2020; Behera et al. 2021). Gupta and Sinha (2018) compiled lichens from the state and mentioned *P. acutalis* R.C. Harris found in the Dhubri district as part of an ongoing study.

Methods

Lichen specimens were collected from 15 locations in the Dhubri district in Assam state. The specimens were collected from the bark of trees, then air dried and stored in acid free paper packets. They were identified morphologically, anatomically and chemically. The morphological characters were studied under a Leica EZ4W stereozoom microscope. For examining anatomical characters, thin sections of the perithecia were mounted in water and observed under a Leica DM 750 compound microscope. The presence of chemical substances was analyzed by performing thin- layer chromatography (Orange et al. 2001) and colour tests using KOH (K), para-phenylenediamine (P) and Calcium hypochlorite (C) solutions. Lichen thallus were also observed under ultraviolet light. The specimens were identified to species following Aptroot (2012) and Upreti (1998) and deposited in the Bodoland University Botanical Herbarium, (BUBH), Department of Botany, Bodoland University (Kokrajhar, Assam, India). A set of voucher specimen is deposited in the herbarium of CSIR–National Botanical Research Institute, LWG; Lucknow Uttar-Pradesh, India

Results

***Pyrenula chlorospila* (Nyl.) Arnold**
Figure 2A–C

Specimens examined. INDIA – **Assam** • Dhubri district, Bidyadabri part v; 26°26′11″N, 089°47′11″E; 34m alt; 21. XII. 2020; S. Biswas & P. Biswas leg.; on the bark of *Lannea* sp.; 2020-0280 (BUBH) • Dhubri district, Debotar hasdaha part 4; 26°05′79″N, 089°83′083″E; 30.23 m alt; 22. XI. 2020; S. Biswas & P. Biswas leg; on the bark of *Lannea* sp.; 2020-0400 (BUBH), 61701 (LWG).

Description. Thallus crustose, corticolous, yellowish; pseudocyphellae present; maculae absent; perithecia numerous, black; ascomata 0.15–0.20 mm in diameter; ostiole white, apical to lateral; peridium black, carbonized, spreading laterally; hamathecium not inspersed, ; hymenium clear; asci 8- spored; ascospores brown, transversely 3-septate; middle locules diamond-shaped and terminal locules triangular with their base towards the end, 26–30 ×10–12 µm.

Chemistry: Thallus K–, C–, P–, TLC–no chemical present.

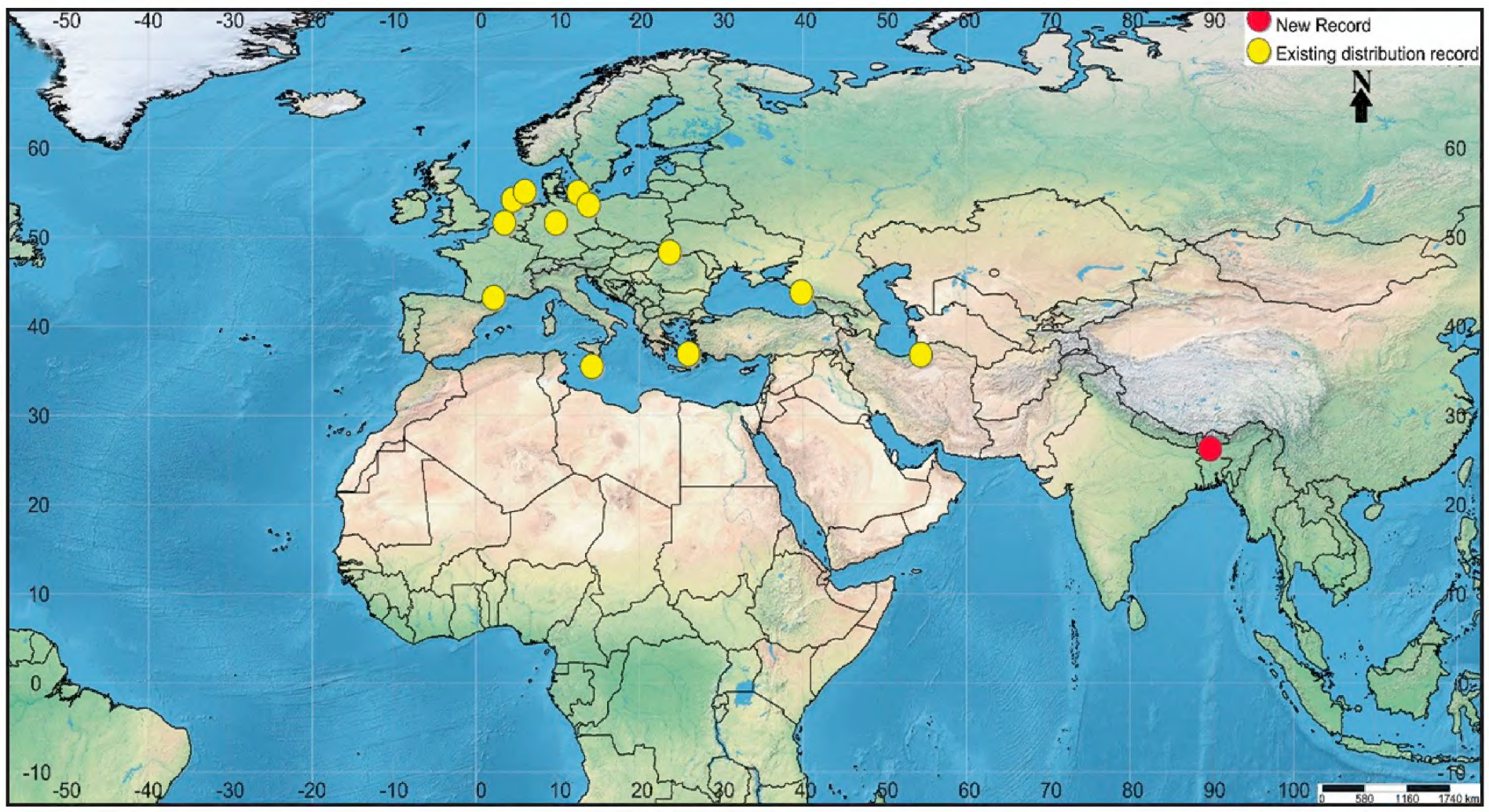

Figure 1. Geographic distribution of *Pyrenula chlorospila* around the world. Yellow circles: occurrence data from GBIF. Red circle: new record of *P. chlorospila* in Assam, India.

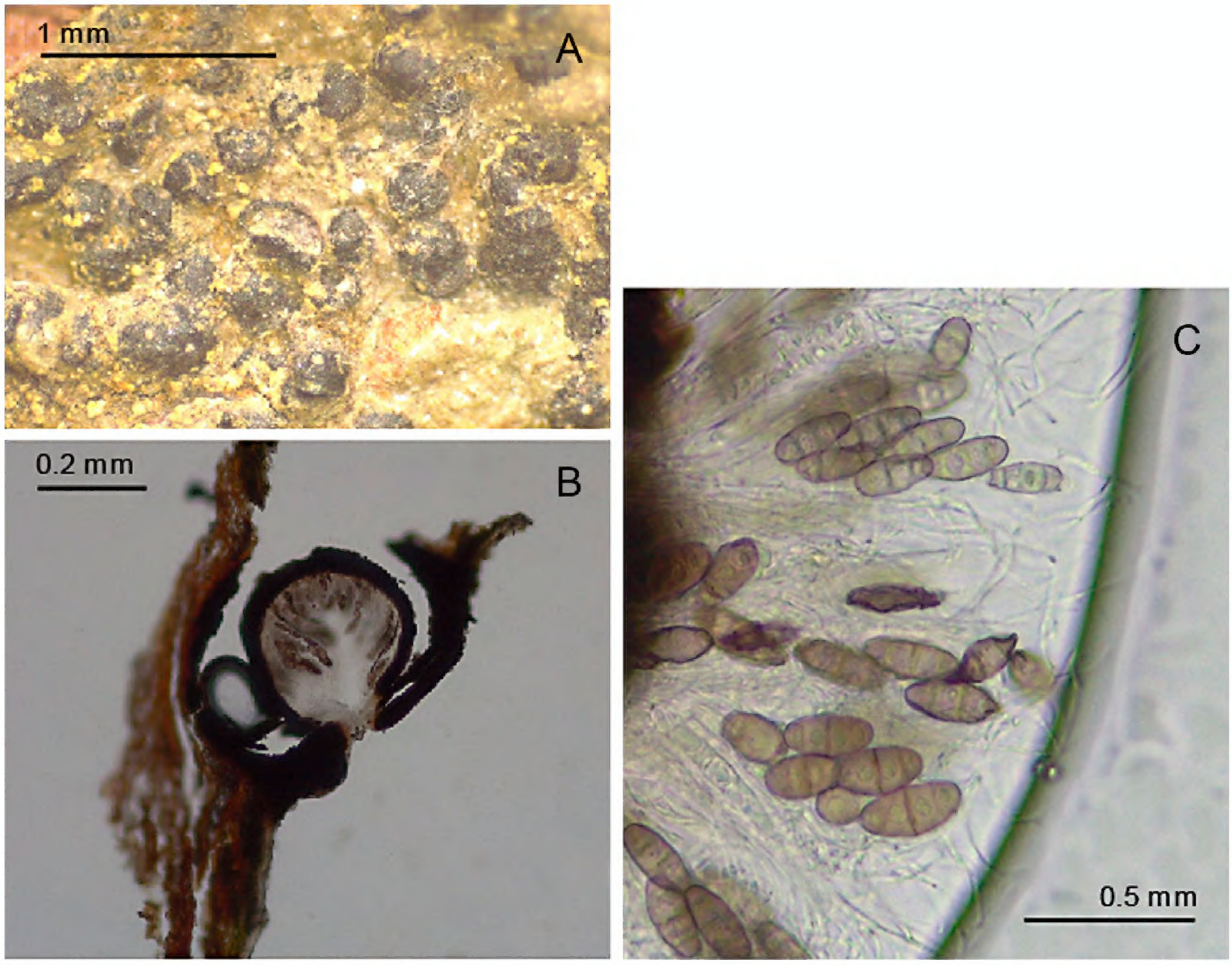

Figure 2. *Pyrenula chlorospila* from Dhubri district, Assam, India. **A.** Habitus with perithecia. **B.** Vertical section of ascomata **C.** Ascospores (26–30 µm).

Ecology. The species was found growing on smooth bark of *Lannea* sp.

Remarks. *Pyrenula chlorospila* is similar with *P. macrospora* (Degel.) Coppins & P. James. (Weerakoon et al. 2012), in its thallus colour, presence of pseudocyphellae on the thallus and absence of chemicals in TLC. Both of the species luxuriously grow on smooth bark of the trees. On the other hand, both of the species differs with their ascomata size. *Pyrenula chlorospila* has 0.1–0.4 mm diameter ascomata but *P. macrospora* has ascomata size approximately 0.5–0.9 mm in diameter (Orange 2013). Globally, *P. chlorospila* is reported from Denmark, France, Germany, Greece, Iran, Ireland, Isle of Man, Malta, the Netherlands, Russian Federation, Spain, Ukraine (GBIF 2022) (Fig. 1).

Discussion

Pyrenula species mostly prefer to grow on the smooth bark of *Alnus*, *Quercus*, and *Ficus* species (Ingle et al. 2018), and in India, most *Pyrenula* species have been found on the smooth bark of *Lannea* sp. and some on the bark of species of *Artocarpous*, *Mangifea*, *Michelia*, *Polyalthia*, and *Ricinus*. Based on the literature (Awasthi 1961; Rout et al. 2005, 2010, 2012; Singh and Sinha 2010; Das et al. 2012, 2013; Gupta et al. 2013; Daimari et al. 2014; Dey et al. 2015; Choudhury et al. 2016; Gupta and Sinha 2018; Gogoi et al. 2019; Joseph et al. 2020; Behera et al. 2021), our record of *P. chlorospila* represents a new addition to the lichen biota of India. With this addition, 12 species of *Pyrenula* have been recorded from Dhubri district (Table 1). As the district is mainly plain with deciduous vegetation, crustose lichens are dominant, although a few foliose genera, *Dirinaria*, *Pyxine*, and *Parmotrema*, also occur.

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Table 1. Distribution of *Pyrenula* species in different localities of Dhubri district, Assam, India. Locations: 1 = Barobaluchar, 2 = Bidyadabri part 5, 3-Bhalukmari, 4 = Bhelupara part 2, 5 = Brahmin para, 6 = Debotar hasdaha part 4, 7 = Dhubri town, 8 = Falimari, 9 = Gaurangtari part 2, 10 = Gauripur, 11 = Golakganj, 12 = Hatipota part 2, 13 = Khajurbari part 1, 14 = Khalilpur, 15 = Kherbari part 2. (+) presence and (–) absence.

***Pyrenula* species**	**Locations**														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
P. acutalis R.C. Harris	–	–	–	–	+	–	–	–	+	–	–	–	–	–	–
P. anomala (Ach.) Vain.	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–
P. approximans (Kremp.) Müll. Arg.	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–
P. breutelii (Müll. Arg.) Aptroot	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–
P. chlorospila (Nyl.) Arnold	–	+	–	–	–	+	–	–	–	–	–	–	–	–	–
P. leucostoma Ach.	–	–	–	–	–	–	+	–	–	+	–	–	–	–	–
P. leucotrypa (Nyl.) Upreti	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–
P. oculata Ajay Singh & Upreti	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
P. quassicola (Fée)	–	–	–	–	–	–	–	–	–	–	+	–	–	–	+
P. sublaevigata (Patw. & Makhija) Upreti	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–
P. submastophora Ajay Singh & Upreti	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–
P. wrightii (Müll. Arg.) R.C. Harris	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–

Authors' Contributions

Conceptualization: SB. Data curation: SB, PI. Formal analysis: SN, DKU, PKS. Funding acquisition: RD.

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